EXHIBIT 1A

BOYCE HYDRO POWER, LLC
A W.D. Boyce Trusts Legacy Enterprise
Stephen B. Hultberg & Lee W. Mueller, Co-Member Managers
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September 30, 2013

The Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, D.C. 20426

Re: P-10808 Edenville PMF Alterations
Additional Evaluations for PMF Designs

Dear Secretary:

We are e-filing herewith our September package of additional information for the PMF passage at our Edenville Project as scheduled in our letter of September 3, 2013.

This report is simultaneously being submitted to the Chicago Regional Office.

Sincerely,
Boyce Hydro Power, LLC

Frank O. Christie, PE
General Manager

cc: L. Mueller
S. Hultberg
FERC, CRO

PMF ALTERATIONS DESIGN PLAN
ADDITIONAL EVALUATIONS
EDENVILLE P-10808
SEPTEMBER 2013 SUBMITTAL

Boyce Hydro Power, LLC
Edenville, Michigan
September 26, 2013

Introduction

This report contains the initial information needed to begin the re-analysis of possible solutions to passage of the PMF at the Edenville Dam. In accordance with Boyce Hydro Power's proposed schedule of September 3, 2013 and the FERC response of September 9, 2013, this submission contains the items scheduled for delivery at the end of September.

1. Feasibility of Pre-lowering the Reservoirs
2. Early Warning System for Emergency Action Plan
3. PMF HEC-RAS Analysis of the Pre-lowered the Reservoirs
4. Flood Frequency Rating

1. Feasibility of Pre-lowering the Reservoirs

Attached are spread sheets No.1 through No. 6 showing the means by which the Edenville, Smallwood and Secord reservoirs may be lowered under different inflow conditions and over 3 or 4 days. Four of the sheets deal with Edenville since that is the largest reservoir and was used to formulate the approach needed. Edenville and Secord need to be lowered eight feet and Smallwood ten feet to reach their gate sill elevations. Two additional sheets, gate discharges and calculations, are provided as background information.

The first portion of the spread sheets (columns 1 through 11) attempted to drain the reservoirs at a constant rate of 1 to 1.33 inches per hour. It became apparent that at sometime during the third day the capacity of the turbines and spillways, at the lowered head, could not provide enough flow to handle the inflow and still lower the reservoir water level. The gates must be opened more in the beginning to get a head start on the lowering process to accomplish the full draw down. The second portion of the sheets (columns 12 through 17) show the variable rates that need to be implemented to reach draw down. The variable rate of draw down was developed by balancing the total volume needed for full draw down (column 6) with the total volume discharged under column 13. When these two totals match the draw down has been accomplished From there we can develop the gate discharge needed and target reservoir elevation at each two hour interval. With our gate discharge table and the target elevations we can regulate the process to achieve the full lowering.

Although the rate is shown as variable, some additional work could develop a stepped approach if that were deemed better from an operational point of view. Over a four day draw down scenario the initial rates of draw down are in the 2 to 2-1/2 inch per hour range. Over a three day draw down the rate begins at about 2-3/4 inches per hour. An earlier analysis[1] showed the embankments to be stable under a rapid draw down condition. These rates therefore safe for an emergency condition.

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[1]Embankment Stability Analysis, Toe Drain Addition, Cross Section Modification and Safety Factor, Edenville Project, February 28, 2009, by Mill Road Engineering, Westborough, MA

No.1			EDENVILLE RESERVOIR DRAWDOWN - 2000 cfs inflow, 4 days						9/23/2013							
			1"/hr Constant rate Col. 1 thru 11								Varible rate per hour Col. 12 thru 17 @47% gates					
							Col. 2+7		Col. 8 - 9	All 6 gates	Col 9-2+%11		Col 12-9+2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					Lowering	Lowering	Total		Gate cfs	Gate cfs	lowering	Volume	Gate	Drawdown	Drawdown	
4 days	Inflow	Reservoir	Head on	Reservoir	Volume of	Discharge	Discharge	Turbine	Discharge	Discharge	Doscharge	Discharged	Discharge	Rate in inch	Rate in feet	Reservoir
hours		Level	Crest	Area - s.f.	Discharge	Needed cfs	Needed cfs	Discharge	Needed	Available	Needed cfs	cf	Rate cfs	per hour	per 2 hours	Level
0	2000	675.8	8	113256000			2000	2170	0	11238	5430		5260	2.10	0.35	675.8
2	2000	675.633	7.833	112514553	18851841	2618	4618	2158	2451	10888	5264	38497199	5096	2.05	0.34	675.45
4	2000	675.466	7.666	111773106	18728020	2601	4601	2165	2436	10542	5099	37307258	4934	2.00	0.33	675.11
6	2000	675.299	7.499	111031659	18604198	2584	4584	2163	2421	10199	4937	36129895	4774	1.95	0.32	674.78
8	2000	675.132	7.332	110290212	18480376	2567	4567	2161	2406	9860	4776	34965246	4615	1.90	0.32	674.45
10	2000	674.965	7.165	109548765	18356555	2550	4550	2159	2391	9525	4617	33813453	4458	1.85	0.31	674.14
12	2000	674.798	6.998	108807318	18232733	2532	4532	2156	2376	9194	4460	32674665	4303	1.80	0.30	673.83
14	2000	674.631	6.831	108065871	18108911	2515	4515	2154	2361	8867	4304	31549034	4150	1.75	0.29	673.53
16	2000	674.464	6.664	107324424	17985090	2498	4498	2152	2346	8544	4151	30436717	3999	1.70	0.28	673.24
18	2000	674.297	6.497	106582977	17861268	2481	4481	2149	2331	8225	3999	29337878	3850	1.65	0.27	672.96
20	2000	674.13	6.33	105841530	17737446	2464	4464	2147	2317	7910	3849	28252688	3702	1.60	0.27	672.68
22	2000	673.963	6.163	105100083	17613625	2446	4446	2145	2302	7599	3701	27181323	3557	1.55	0.26	672.42
24	2000	673.796	5.996	104358636	17489803	2429	4429	2142	2287	7292	3555	26123967	3413	1.50	0.25	672.16
26	2000	673.629	5.829	103617189	17365981	2412	4412	2140	2272	6989	3412	25080810	3271	1.45	0.24	671.91
28	2000	673.462	5.662	102875742	17242160	2395	4395	2138	2257	6691	3270	24052053	3132	1.40	0.23	671.67
30	2000	673.295	5.495	102134295	17118338	2378	4378	2136	2242	6397	3130	23037803	2994	1.35	0.22	671.43
32	2000	673.128	5.328	101392848	16994516	2360	4360	2133	2227	6108	2992	22038577	2859	1.30	0.22	671.21
34	2000	672.961	5.161	100651401	16870695	2343	4343	2131	2212	5823	2856	21054303	2725	1.25	0.21	670.99
36	2000	672.794	4.994	99909954	16746873	2326	4326	2129	2197	5543	2723	20085318	2594	1.20	0.20	670.78
38	2000	672.627	4.827	99168507	16623051	2309	4309	2126	2182	5267	2592	19131871	2465	1.15	0.19	670.58
40	2000	672.46	4.66	98427060	16499230	2292	4292	2124	2168	4996	2462	18194226	2338	1.10	0.18	670.39
42	2000	672.293	4.493	97685613	16375408	2274	4274	2122	2153	4730	2338	17272657	2214	1.06	0.18	670.21
44	2000	672.126	4.326	96944166	16251587	2257	4257	2119	2138	4469	2211	16367457	2092	1.01	0.17	670.03
46	2000	671.959	4.159	96202719	16127765	2240	4240	2117	2123	4212	2089	15478932	1972	0.96	0.16	669.86
48	2000	671.792	3.992	95461272	16003943	2223	4223	2115	2108	3961	1969	14607407	1854	0.91	0.15	669.70
50	2000	671.625	3.825	94719825	15880122	2206	4206	2113	2093	3715	1851	13753228	1739	0.87	0.14	669.55
52	2000	671.458	3.658	93978378	15756300	2188	4188	2110	2078	3475	1737	12916762	1626	0.82	0.14	669.41
54	2000	671.291	3.491	93236931	15632478	2171	4171	2108	2063	3239	1624	12098400	1516	0.78	0.13	669.27
56	2000	671.124	3.324	92495484	15508657	2154	4154	2106	2048	3010	1514	11298561	1409	0.73	0.12	669.14
58	2000	670.957	3.157	91754037	15384835	2137	4137	2103	2033	2786	1407	10517694	1304	0.69	0.11	669.02
60	2000	670.79	2.99	91012590	15261013	2120	4120	2101	2019	2568	1303	9756283	1202	0.64	0.11	668.90
62	2000	670.623	2.823	90271143	15137192	2102	4102	2099	2004	2356	1201	9014850	1103	0.60	0.10	668.80
64	2000	670.456	2.656	89529696	15013370	2085	4085	2096	1989	2150	1103	8293962	1006	0.55	0.09	668.70
66	2000	670.289	2.489	88788249	14889548	2068	4068	2094	1974	1950	1007	7594237	913	0.51	0.09	668.61
68	2000	670.122	2.322	88046802	14765727	2051	4051	2092	1959	1757	914	6916354	823	0.47	0.08	668.52
70	2000	669.955	2.155	87305355	14641905	2034	4034	2089	1944	1571	825	6261060	735	0.43	0.07	668.44
72	2000	669.788	1.988	86563908	14518083	2016	4016	2087	1929	1392	739	5629184	652	0.39	0.06	668.37
74	2000	669.621	1.821	85822461	14394262	1999	3999	2085	1914	1220	656	5021657	571	0.35	0.06	668.31
76	2000	669.454	1.654	85081014	14270440	1982	3982	2083	1899	1056	577	4439528	494	0.31	0.05	668.25
78	2000	669.287	1.487	84339567	14146619	1965	3965	2080	1885	901	502	3883997	422	0.28	0.05	668.20
80	2000	669.12	1.32	83598120	14022797	1948	3948	2078	1870	753	431	3356450	353	0.24	0.04	668.15
82	2000	668.953	1.153	82856673	13898975	1930	3930	2076	1855	615	363	2858520	288	0.21	0.03	668.11
84	2000	668.786	0.986	82115226	13775154	1913	3913	2073	1840	486	301	2392163	228	0.17	0.03	668.08
86	2000	668.619	0.819	81373779	13651332	1896	3896	2071	1825	368	243	1959789	172	0.14	0.02	668.05
88	2000	668.452	0.652	80632332	13527510	1879	3879	2069	1810	261	191	1564468	122	0.12	0.02	668.02
90	2000	668.285	0.485	79890885	13403689	1862	3862	2066	1795	168	145	1210307	79	0.09	0.02	668.00
92	2000	668.118	0.318	79149438	13279867	1844	3844	2064	1780	89	106	903243	42	0.07	0.01	667.99
94	2000	667.951	0.151	78407991	13156045	1827	3827	2062	1765	29	76	653131	14	0.05	0.01	667.98
96	0	667.784	0	77666544	13032224	1810	0	0	0	0	0	271943	0	0.02	0.00	667.97
					765217556	c.f.						765236611				

No.2 EDENVILLE RESERVOIR DRAWDOWN - 2000 cfs Inflow, 3 days 9/23/2013

1.33"/hr Constant rate Col. 1 thru 11 | Varible rate per hour Col. 12 thru 17 @ 63% gates

							Col. 2 + 7		Col. 8 - 9	All 6 gates	Col 9-2+%11		Col 12-9+2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Time-hrs 4 days	Inflow	Reservoir Level	Head on Crest	Reservoir Area - s.f.	Lowering Volume cf Discharge	Lowering Discharge Needed cfs	Total Discharge Needed cfs	Turbine Discharge	Gate cfs Discharge Needed	Gate cfs Discharge Available	Lowering Discharge Needed cfs	Volume Discharged c.f.	Gate Discharge Rate cfs	Drawdown Rate in Inch per hour	Drawdown Rate in feet per 2 hours	Reservoir Level
0	2000	675.8	8	113256000		0	2000	2170	0	11236	7194		7024	2.78	0.46	675.80
2	2000	675.578	7.778	112260343	25032314	3477	5477	2188	3309	10773	6901	50741136	6733	2.70	0.45	675.34
4	2000	675.356	7.556	111264686	24811278	3446	5446	2165	3281	10315	6613	48649056	6447	2.61	0.44	674.89
6	2000	675.134	7.334	110269029	24590242	3415	5415	2163	3252	9864	6328	46586819	6165	2.52	0.42	674.45
8	2000	674.912	7.112	109273372	24369207	3385	5385	2161	3224	9420	6048	44554860	5887	2.44	0.41	674.03
10	2000	674.69	6.89	108277715	24148171	3354	5354	2159	3195	8982	5772	42553643	5614	2.35	0.39	673.62
12	2000	674.468	6.668	107282058	23927135	3323	5323	2156	3167	8552	5501	40583652	5345	2.26	0.38	673.23
14	2000	674.246	6.446	106286401	23706099	3293	5293	2154	3139	8128	5234	38645395	5080	2.17	0.36	672.86
16	2000	674.024	6.224	105290744	23485063	3262	5262	2152	3110	7712	4971	36739405	4820	2.08	0.35	672.50
18	2000	673.802	6.002	104295087	23264027	3231	5231	2149	3082	7303	4714	34866242	4564	2.00	0.33	672.15
20	2000	673.58	5.78	103299430	23042991	3200	5200	2147	3053	6901	4460	33026499	4313	1.91	0.32	671.82
22	2000	673.358	5.558	102303773	22821956	3170	5170	2145	3025	6508	4212	31220798	4067	1.82	0.30	671.50
24	2000	673.136	5.336	101308116	22600920	3139	5139	2142	2997	6122	3968	29449802	3825	1.74	0.29	671.19
26	2000	672.914	5.114	100312459	22379884	3108	5108	2140	2968	5744	3730	27714211	3590	1.65	0.27	670.90
28	2000	672.692	4.892	99316802	22158848	3078	5078	2138	2940	5374	3496	26014770	3359	1.56	0.26	670.63
30	2000	672.47	4.67	98321145	21937812	3047	5047	2136	2911	5012	3268	24352273	3133	1.48	0.25	670.37
32	2000	672.248	4.448	97325488	21716778	3016	5016	2133	2883	4659	3045	22727570	2912	1.39	0.23	670.12
34	2000	672.026	4.226	96329831	21495740	2986	4986	2131	2855	4315	2828	21141571	2697	1.31	0.22	669.89
36	2000	671.804	4.004	95334174	21274705	2955	4955	2129	2826	3979	2616	19595255	2487	1.23	0.20	669.67
38	2000	671.582	3.782	94338517	21053669	2924	4924	2126	2798	3653	2409	18089682	2283	1.14	0.19	669.47
40	2000	671.36	3.56	93342860	20832633	2893	4893	2124	2759	3336	2209	16625999	2085	1.06	0.18	669.28
42	2000	671.138	3.338	92347203	20611597	2863	4863	2122	2741	3029	2015	15205456	1893	0.98	0.16	669.10
44	2000	670.916	3.116	91351546	20390561	2832	4832	2119	2713	2732	1827	13829424	1707	0.90	0.15	668.94
46	2000	670.694	2.894	90355889	20169525	2801	4801	2117	2684	2445	1645	12499413	1526	0.83	0.14	668.78
48	2000	670.472	2.572	89360232	19948489	2771	4771	2115	2656	2169	1471	11217097	1355	0.75	0.12	668.65
50	2000	670.25	2.45	88364575	19727454	2740	4740	2113	2627	1905	1303	9984351	1190	0.67	0.11	668.52
52	2000	670.028	2.228	87368918	19506418	2709	4709	2110	2599	1652	1142	8803285	1032	0.60	0.10	668.41
54	2000	669.806	2.006	86373261	19285382	2679	4679	2108	2571	1411	990	7676312	882	0.53	0.09	668.31
56	2000	669.584	1.784	85377604	19064346	2648	4648	2106	2542	1183	845	6606213	740	0.46	0.08	668.22
58	2000	669.362	1.562	84381947	18843310	2617	4617	2103	2514	970	709	5596255	606	0.40	0.07	668.14
60	2000	669.14	1.34	83386290	18622274	2586	4586	2101	2485	770	582	4650342	481	0.33	0.06	668.08
62	2000	668.918	1.118	82390633	18401238	2556	4556	2099	2457	587	466	3773264	367	0.27	0.05	668.02
64	2000	668.696	0.896	81394976	18180203	2525	4525	2096	2429	421	360	2971091	263	0.22	0.04	667.98
66	2000	668.474	0.674	80399319	17959167	2494	4494	2094	2400	275	266	2251886	172	0.17	0.03	667.94
68	2000	668.252	0.452	79403662	17738131	2464	4464	2092	2372	151	186	1627152	94	0.12	0.02	667.91
70	2000	668.03	0.23	78408005	17517095	2433	4433	2089	2343	55	124	1115520	34	0.08	0.01	667.89
72	0	667.808	0.008	77412348	17296059	2402	2402	0	2402	0	0	446260	0	0.03	0.01	667.88
					761910719	c.f.						762131961				

No. 3			EDENVILLE RESERVOIR DRAWDOWN - 1500 cfs inflow, 4 days						9/23/2013							
			1"/hr Constant rate Col. 1 thru 11								Varible rate per hour Col. 12 thru 17 @ 85% gates					
							Col. 2+7		Col. 8 - 9	All 6 gates	Col 9-2+%11		Col 12-9+2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4 days hours	Inflow	Reservoir Level	Head on Crest	Reservoir Area - s.f.	Lowering Volume of Discharge	Lowering Discharge Needed cfs	Total Discharge Needed cfs	Turbine Discharge	Gate cfs Discharge Needed	Gate cfs Discharge Available	lowering Discharge Needed cfs	Volume Discharged cf	Gate Discharge Rate cfs	Drawdown Rate in inch per hour	Drawdown Rate in feet per 2 hours	Reservoir Level
0	1500	675.8	6	113256000		0	1500	2170	-670	11238	4572		3902	1.79	0.29	675.8
2	1500	675.633	7.833	112514553	18851841	2618	4118	2168	1951	10868	4448	32916969	3780	1.75	0.29	675.51
4	1500	675.466	7.666	111773106	18728020	2601	4101	2165	1936	10542	4325	32025354	3660	1.71	0.29	675.22
6	1500	675.299	7.499	111031659	18604198	2584	4084	2163	1921	10199	4204	31143019	3541	1.68	0.28	674.93
8	1500	675.132	7.332	110290212	18480376	2567	4067	2161	1906	9860	4084	30270064	3423	1.64	0.27	674.65
10	1500	674.965	7.165	109548765	18356555	2550	4050	2159	1891	9525	3966	29406592	3307	1.61	0.27	674.38
12	1500	674.798	6.998	108807318	18232733	2532	4032	2156	1876	9194	3848	28552710	3192	1.57	0.26	674.11
14	1500	674.631	6.831	108065871	18108911	2515	4015	2154	1861	8867	3733	27708531	3079	1.53	0.26	673.85
16	1500	674.464	6.664	107324424	17985090	2498	3998	2152	1846	8544	3618	26874169	2966	1.50	0.25	673.60
18	1500	674.297	6.497	106582977	17861268	2481	3981	2149	1831	8225	3505	26049744	2856	1.46	0.24	673.35
20	1500	674.13	6.33	105841530	17737446	2464	3964	2147	1817	7910	3393	25235379	2746	1.43	0.24	673.10
22	1500	673.963	6.163	105100083	17613625	2446	3946	2145	1802	7599	3283	24431202	2638	1.39	0.23	672.86
24	1500	673.796	5.996	104358636	17489803	2429	3929	2142	1787	7292	3174	23637348	2532	1.35	0.23	672.63
26	1500	673.629	5.829	103617189	17365981	2412	3912	2140	1772	6989	3067	22853954	2427	1.32	0.22	672.41
28	1500	673.462	5.662	102875742	17242160	2395	3895	2138	1757	6691	2961	22081167	2323	1.28	0.21	672.19
30	1500	673.295	5.495	102134295	17118338	2378	3878	2136	1742	6397	2857	21319137	2221	1.25	0.21	671.97
32	1500	673.128	5.328	101392848	16994516	2360	3860	2133	1727	6108	2754	20568020	2121	1.21	0.20	671.77
34	1500	672.961	5.161	100651401	16870695	2343	3843	2131	1712	5823	2653	19827983	2022	1.18	0.20	671.56
36	1500	672.794	4.994	99909954	16746873	2326	3826	2129	1697	5543	2553	19099197	1924	1.14	0.19	671.37
38	1500	672.627	4.827	99168507	16623051	2309	3809	2126	1682	5267	2455	18381843	1829	1.11	0.18	671.18
40	1500	672.46	4.66	98427060	16499230	2292	3792	2124	1668	4995	2359	17676110	1735	1.07	0.18	670.99
42	1500	672.293	4.493	97685613	16375408	2274	3774	2122	1653	4730	2264	16982199	1642	1.04	0.17	670.81
44	1500	672.126	4.326	96944166	16251587	2257	3757	2119	1638	4469	2171	16300318	1552	1.01	0.17	670.64
46	1500	671.959	4.159	96202719	16127765	2240	3740	2117	1623	4212	2080	15630690	1463	0.97	0.16	670.47
48	1500	671.792	3.992	95461272	16003943	2223	3723	2115	1608	3961	1990	14973548	1375	0.94	0.16	670.31
50	1500	671.625	3.825	94719825	15880122	2206	3706	2113	1593	3715	1902	14329142	1290	0.90	0.15	670.15
52	1500	671.458	3.658	93978378	15756300	2188	3688	2110	1578	3475	1817	13697735	1206	0.87	0.15	670.00
54	1500	671.291	3.491	93236931	15632478	2171	3671	2108	1563	3239	1733	13079608	1125	0.84	0.14	669.86
56	1500	671.124	3.324	92495484	15508657	2154	3654	2106	1548	3010	1651	12475060	1045	0.81	0.13	669.72
58	1500	670.957	3.157	91754037	15384835	2137	3637	2103	1533	2786	1571	11884413	967	0.77	0.13	669.58
60	1500	670.79	2.99	91012590	15261013	2120	3620	2101	1519	2568	1493	11308013	892	0.74	0.12	669.46
62	1500	670.623	2.823	90271143	15137192	2102	3602	2099	1504	2356	1417	10746230	818	0.71	0.12	669.33
64	1500	670.456	2.656	89529696	15013370	2085	3585	2096	1489	2150	1343	10199469	746	0.68	0.11	669.21
66	1500	670.289	2.489	88788249	14889548	2068	3568	2094	1474	1950	1271	9668168	677	0.65	0.11	669.10
68	1500	670.122	2.322	88046802	14765727	2051	3551	2092	1459	1757	1202	9152805	610	0.62	0.10	668.99
70	1500	669.955	2.155	87305355	14641905	2034	3534	2089	1444	1571	1135	8653907	546	0.59	0.10	668.89
72	1500	669.788	1.988	86563908	14518083	2016	3516	2087	1429	1392	1071	8172057	483	0.56	0.09	668.79
74	1500	669.621	1.821	85822461	14394262	1999	3499	2085	1414	1220	1009	7707904	424	0.54	0.09	668.69
76	1500	669.454	1.654	85081014	14270440	1982	3482	2083	1399	1056	949	7262177	367	0.51	0.08	668.61
78	1500	669.287	1.487	84339567	14146619	1965	3465	2080	1385	901	893	6635705	313	0.48	0.08	668.52
80	1500	669.12	1.32	83598120	14022797	1948	3448	2078	1370	753	840	6429438	292	0.46	0.08	668.44
82	1500	668.953	1.153	82856673	13898975	1930	3430	2076	1355	615	789	6044484	213	0.44	0.07	668.36
84	1500	668.786	0.986	82115226	13775154	1913	3413	2073	1340	486	742	5682156	169	0.41	0.07	668.29
86	1500	668.619	0.819	81373779	13651332	1896	3396	2071	1325	368	699	5344045	128	0.39	0.07	668.22
88	1500	668.452	0.652	80632332	13527510	1879	3379	2068	1310	261	660	5032133	91	0.37	0.06	668.16
90	1500	668.285	0.485	79890885	13403689	1862	3362	2066	1295	168	625	4748993	58	0.36	0.06	668.09
92	1500	668.118	0.318	79149438	13279867	1844	3344	2064	1280	89	595	4498149	31	0.34	0.06	668.04
94	1500	667.951	0.151	78407991	13156045	1827	3327	2062	1265	29	572	4284880	10	0.33	0.05	667.98
96	1500	667.784	0	77666544	13032224	1810	3310	2050	1250	0	560	4116530	0	0.32	0.05	667.92
					765217556	c.f.						765300448				

No. 4

EDENVILLE RESERVOIR DRAWDOWN - 2500 cfs inflow, 4 days — 9/23/2013

1"/hr Constant rate Col. 1 thru 11

Varible rate per hour Col. 12 thru 17 @50% gates

1	2	3	4	5	6	7	8 (Col. 2 + 7)	9	10 (Col. 8 - 9)	11 (All 5 gates)	12 (Col 9-2+%11)	13	14 (Col 12-9+2)	15	16	17
4 days hours	Inflow	Reservoir Level	Head on Crest	Reservoir Area - s.f.	Lowering Volume cf Discharge	Lowering Discharge Needed cfs	Total Discharge Needed cfs	Turbine Discharge	Gate cfs Discharge Needed	Gate cfs Discharge Available	Lowering Discharge Needed cfs	Volume Discharged cf	Gate Discharge Rate cfs	Drawdown Rate in Inch per hour	Drawdown Rate in feet per 2 hours	Reservoir Level
0	2500	675.8	8	113256000		0	2500	2170	330	11238	5261		5591	2.04	0.35	675.8
2	2500	675.633	7.833	112514553	18851841	2618	5118	2168	2951	10888	5084	37242973	5417	1.98	0.34	675.45
4	2500	675.466	7.666	111773106	18728020	2601	5101	2165	2936	10542	4910	35979203	5244	1.92	0.33	675.11
6	2500	675.299	7.499	111031659	18604198	2584	5084	2163	2921	10199	4737	34728801	5074	1.87	0.32	674.78
8	2500	675.132	7.332	110290212	18480376	2567	5067	2161	2906	9860	4566	33491913	4905	1.82	0.31	674.46
10	2500	674.965	7.165	109548765	18356555	2550	5050	2159	2891	9525	4397	32268691	4739	1.76	0.30	674.15
12	2500	674.798	6.998	108807318	18232733	2532	5032	2156	2876	9194	4230	31059292	4574	1.71	0.29	673.84
14	2500	674.631	6.831	108065871	18108911	2515	5015	2154	2861	8867	4065	29863876	4411	1.65	0.28	673.55
16	2500	674.464	6.664	107324424	17985090	2498	4998	2152	2846	8544	3902	28682614	4251	1.60	0.28	673.27
18	2500	674.297	6.497	106582977	17861268	2481	4981	2149	2831	8225	3741	27515678	4092	1.54	0.27	672.99
20	2500	674.13	6.33	105841530	17737446	2464	4964	2147	2817	7910	3582	26363249	3935	1.49	0.26	672.73
22	2500	673.963	6.163	105100083	17613625	2446	4946	2145	2802	7599	3425	25225515	3780	1.44	0.25	672.47
24	2500	673.796	5.996	104358636	17489803	2429	4929	2142	2787	7292	3270	24102671	3628	1.38	0.24	672.22
26	2500	673.629	5.829	103617189	17365981	2412	4912	2140	2772	6989	3117	22994921	3477	1.33	0.23	671.98
28	2500	673.462	5.662	102875742	17242160	2395	4895	2138	2757	6691	2967	21902475	3329	1.27	0.22	671.75
30	2500	673.295	5.496	102134295	17118338	2378	4878	2136	2742	6397	2818	20825556	3183	1.22	0.21	671.53
32	2500	673.128	5.328	101392848	16994516	2360	4860	2133	2727	6108	2672	19764394	3039	1.17	0.20	671.32
34	2500	672.961	5.161	100651401	16870695	2343	4843	2131	2712	5823	2528	18719231	2897	1.11	0.19	671.11
36	2500	672.794	4.994	99909954	16746873	2326	4826	2129	2697	5543	2385	17690318	2758	1.06	0.19	670.92
38	2500	672.627	4.827	99168507	16623051	2309	4809	2126	2682	5267	2247	16677922	2620	1.01	0.18	670.73
40	2500	672.46	4.66	98427060	16499230	2282	4792	2124	2666	4996	2110	15682322	2486	0.95	0.17	670.56
42	2500	672.293	4.493	97685613	16375408	2274	4774	2122	2653	4730	1975	14703809	2353	0.90	0.16	670.39
44	2500	672.126	4.326	96944166	16251587	2257	4757	2119	2638	4469	1843	13742695	2223	0.85	0.15	670.23
46	2500	671.959	4.159	96202719	16127765	2240	4740	2117	2623	4212	1713	12799305	2096	0.80	0.14	670.08
48	2500	671.792	3.992	95461272	16003943	2223	4723	2115	2608	3961	1586	11873986	1971	0.74	0.13	669.94
50	2500	671.625	3.825	94719825	15880122	2206	4706	2113	2593	3715	1461	10967103	1848	0.69	0.12	669.81
52	2500	671.458	3.658	93978378	15756300	2188	4688	2110	2578	3475	3085	16364761	3475	1.04	0.12	669.68
54	2500	671.291	3.491	93236931	15632478	2171	4671	2108	2563	3239	2847	21356157	3239	1.37	0.17	669.57
56	2500	671.124	3.324	92495484	15508657	2154	4654	2106	2548	3010	2615	19666113	3010	1.27	0.23	669.40
58	2500	670.957	3.157	91754037	15384835	2137	4637	2103	2533	2786	2389	18016594	2795	1.17	0.21	669.17
60	2500	670.79	2.99	91012590	15261013	2120	4620	2101	2519	2566	2169	16408641	2568	1.08	0.20	668.96
62	2500	670.623	2.823	90271143	15137192	2102	4602	2099	2504	2358	1954	14843372	2356	0.98	0.18	668.76
64	2500	670.456	2.656	89529696	15013370	2085	4585	2096	2489	2150	1746	13321999	2150	0.89	0.16	668.58
66	2500	670.289	2.489	88788249	14889548	2068	4568	2094	2474	1950	1544	11845841	1950	0.80	0.15	668.42
68	2500	670.122	2.322	88046802	14765727	2051	4551	2092	2459	1757	1349	10416348	1757	0.71	0.13	668.27
70	2500	669.955	2.155	87305355	14641905	2034	4534	2089	2444	1571	1161	9035117	1571	0.62	0.12	668.14
72	2500	669.788	1.988	86563908	14518083	2018	4516	2087	2429	1392	979	7703921	1392	0.53	0.10	668.02
74	2500	669.621	1.821	85822461	14394262	1999	4499	2085	2414	1220	805	6424746	1220	0.45	0.09	667.91
76	2500	669.454	1.654	85081014	14270440	1982	4482	2083	2399	1056	639	5199835	1056	0.37	0.07	667.83
78	2500	669.287	1.487	84339567	14146619	1965	4465	2080	2385	901	481	4031749	901	0.29	0.06	667.75
80	2500	669.12	1.32	83598120	14022797	1948	4448	2078	2370	753	331	2923454	753	0.21	0.05	667.69
82	2500	668.953	1.153	82856673	13898975	1930	4430	2076	2355	615	191	1878435	615	0.14	0.03	667.64
84	2500	668.786	0.986	82115226	13775154	1913	4413	2073	2340	486	80	900874	486	0.07	0.02	667.61
86	2500	668.619	0.819	81373779	13651332	1896	4396	2071	2325	368	0	214765	0	0.02	0.01	667.59
88	2500	668.452	0.652	80632332	13527510	1879	4379	2068	2310	261	0	0	0	0.00	0.00	667.57
90	2500	668.285	0.485	79890885	13403689	1862	4362	2066	2295	168	0	0	0	0.00	0.00	667.57
92	2500	668.118	0.318	79149438	13279867	1844	4344	2064	2280	89	0	0	0	0.00	0.00	667.57
94	2500	667.951	0.151	78407991	13156045	1827	4327	2062	2265	29	0	0	0	0.00	0.00	667.57
96	2500	667.784	0	77666544	13032224	1810	4310	2060	2250	0	0	0	0	0.00	0.00	667.57
					766217556 c.f.							765421244				
											100% of gates at hr. 52					

No. 5			SECORD RESERVOIR DRAWDOWN - 425 cfs inflow, 4 days						9/23/2013							
			1"/hr Constant rate Col. 1 thru 11								Varible rate per hour Col. 12 thru 17 @ 58% of gates					
							Col. 2 + 7		Col. 8 - 9	All 6 gates	Col 9-2+%11		Col 12-9+2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4 days hours	Inflow	Reservoir Level	Head on Crest	Reservoir Area - s.f.	Lowering Volume of Discharge	Lowering Discharge Needed cfs	Total Discharge Needed cfs	Turbine Discharge	Gate cfs Discharge Needed	Gate cfs Discharge Available	lowering Discharge Needed cfs	Volume Discharged cf	Gate Discharge Rate cfs	Drawdown Rate in inch per hour	Drawdown Rate in feet per 2 hours	Reservoir Level
0	425	750.8	8	47916000			425	450	0	3833	2229		2204	2.07	0.35	750.8
2	425	750.633	7.833	47545277	7971017	1107	1532	449	1083	3714	2159	18048970	2135	2.02	0.34	750.46
4	425	750.466	7.666	47174554	7909106	1098	1523	448	1075	3596	2090	15547475	2067	1.97	0.33	750.12
6	425	750.299	7.499	46803831	7847195	1090	1515	447	1068	3479	2022	15051221	2000	1.92	0.32	749.79
8	425	750.132	7.332	46433108	7785284	1081	1506	446	1060	3363	1955	14560266	1934	1.87	0.31	749.47
10	425	749.965	7.165	46062385	7723374	1073	1498	445	1053	3249	1888	14074668	1868	1.83	0.30	749.16
12	425	749.798	6.998	45691662	7661463	1064	1489	444	1045	3136	1822	13594488	1803	1.78	0.30	748.85
14	425	749.631	6.831	45320939	7599552	1055	1480	443	1037	3024	1757	13119788	1739	1.73	0.29	748.56
16	425	749.464	6.664	44950216	7537641	1047	1472	442	1030	2914	1693	12650633	1675	1.68	0.28	748.27
18	425	749.297	6.497	44579493	7475731	1038	1463	441	1022	2805	1629	12187082	1613	1.63	0.27	747.99
20	425	749.13	6.33	44208770	7413820	1030	1455	440	1015	2698	1566	11729233	1551	1.59	0.26	747.72
22	425	748.963	6.163	43838047	7351909	1021	1446	439	1007	2592	1504	11277129	1490	1.54	0.26	747.45
24	425	748.796	5.996	43467324	7289998	1012	1437	438	999	2487	1443	10830856	1430	1.49	0.25	747.20
26	425	748.629	5.829	43096601	7228088	1004	1429	437	992	2384	1383	10390493	1371	1.44	0.24	746.95
28	425	748.462	5.662	42725878	7166177	995	1420	436	984	2282	1323	9956120	1312	1.39	0.23	746.71
30	425	748.295	5.495	42355155	7104266	987	1412	435	977	2182	1265	9527824	1255	1.34	0.22	746.48
32	425	748.128	5.328	41984432	7042356	978	1403	434	969	2083	1207	9105692	1198	1.30	0.22	746.25
34	425	747.961	5.161	41613709	6980445	970	1395	433	962	1986	1150	8689819	1142	1.25	0.21	746.04
36	425	747.794	4.994	41242986	6918534	961	1386	432	954	1891	1094	8280302	1087	1.20	0.20	745.83
38	425	747.627	4.827	40872263	6856623	952	1377	431	946	1797	1039	7877242	1033	1.15	0.19	745.63
40	425	747.46	4.66	40501540	6794713	944	1369	430	939	1704	985	7480747	980	1.10	0.18	745.44
42	425	747.293	4.493	40130817	6732802	935	1360	429	931	1613	932	7090929	928	1.06	0.18	745.25
44	425	747.126	4.326	39760094	6670891	927	1352	428	924	1524	879	6707907	876	1.01	0.17	745.08
46	425	746.959	4.159	39389371	6608980	918	1343	427	916	1437	826	6331806	825	0.96	0.16	744.91
48	425	746.792	3.992	39018648	6547070	909	1334	426	908	1351	778	5962758	777	0.91	0.15	744.75
50	425	746.625	3.825	38647925	6485159	901	1326	425	901	1267	729	5600905	729	0.87	0.14	744.60
52	425	746.458	3.658	38277202	6423248	892	1317	424	893	1185	680	5246394	681	0.82	0.14	744.45
54	425	746.291	3.491	37906479	6361337	884	1309	423	886	1105	633	4899385	635	0.77	0.13	744.32
56	425	746.124	3.324	37535756	6299427	875	1300	422	878	1027	587	4560046	590	0.73	0.12	744.19
58	425	745.957	3.157	37165033	6237516	866	1291	421	870	950	542	4228560	546	0.68	0.11	744.07
60	425	745.79	2.99	36794310	6175605	858	1283	420	863	876	499	3905121	504	0.63	0.11	743.95
62	425	745.623	2.823	36423587	6113694	849	1274	419	855	803	456	3589938	462	0.59	0.10	743.85
64	425	745.456	2.656	36052864	6051784	841	1266	418	848	733	415	3283243	422	0.54	0.09	743.75
66	425	745.289	2.489	35682141	5989873	832	1257	417	840	665	374	2985279	382	0.50	0.08	743.66
68	425	745.122	2.322	35311418	5927962	823	1248	416	832	599	336	2696319	345	0.46	0.08	743.58
70	425	744.955	2.155	34940695	5866051	815	1240	415	825	536	298	2416659	308	0.41	0.07	743.50
72	425	744.788	1.988	34569972	5804141	806	1231	414	817	475	262	2146629	273	0.37	0.06	743.43
74	425	744.621	1.821	34199249	5742230	798	1223	413	810	416	227	1886595	239	0.33	0.05	743.37
76	425	744.454	1.654	33828526	5680319	789	1214	412	802	360	194	1636971	207	0.29	0.05	743.31
78	425	744.287	1.487	33457803	5618408	780	1205	411	794	307	163	1398222	177	0.25	0.04	743.27
80	425	744.12	1.32	33087080	5556498	772	1197	410	787	257	133	1170887	148	0.21	0.04	743.22
82	425	743.953	1.153	32716357	5494587	763	1188	409	779	210	105	955591	121	0.17	0.03	743.19
84	425	743.786	0.986	32345634	5432676	755	1180	408	772	166	78	753076	95	0.14	0.02	743.16
86	425	743.619	0.819	31974911	5370766	746	1171	407	764	126	54	564240	72	0.11	0.02	743.14
88	425	743.452	0.652	31604188	5308855	737	1162	406	756	89	32	390204	51	0.07	0.01	743.12
90	425	743.285	0.485	31233465	5246944	729	1154	405	749	57	13	232420	33	0.04	0.01	743.11
92	425	743.118	0.318	30862742	5185033	720	1145	404	741	30	0	92879	21	0.02	0.00	743.10
94	425	742.951	0.151	30492019	5123123	712	1137	403	734	10	0	0	22	0.00	0.00	743.10
96	425	742.784	0	30121296	5061212	703	1128	402	726	0	0	0	23	0.00	0.00	743.10
					312773482	c.f.						312713019				

No. 6			SNALLWOOD RESERVOIR DRAWDOWN - 725 cfs inflow, 4 days							9/23/2013	Varible rate per hour Col. 12 thru 17 @ 20% gates					
			1.25"/hr Constant rate Col. 1 thru 11													
							Col. 2+7		Col. 8 - 9	All 6 gates	Col 9-2+%11		Col 12-9+2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4 days hours	Inflow	Reservoir Level	Head on Crest	Reservoir Area - s.f.	Lowering Volume cf Discharge	Lowering Discharge Needed cfs	Total Discharge Needed cfs	Turbine Discharge	Gate cfs Discharge Needed	Gate cfs Discharge Available	lowering Discharge Needed cfs	Volume Discharged cf	Gate Discharge Rate cfs	Drawdown Rate in inch per hour	Drawdown Rate in feet per hour	Reservoir Level
0	725	704.8	10	21780000			725	750	0	6087	1182		1157	2.40	0.40	704.8
2	725	704.592	9.792	21594639	4510962	627	1352	750	602	5898	1146	8507542	1121	2.35	0.39	704.40
4	725	704.384	9.584	21409278	4472407	621	1346	750	596	5712	1110	8249078	1085	2.30	0.38	704.01
6	725	704.176	9.376	21223917	4433852	616	1341	750	591	5527	1075	7993346	1050	2.25	0.37	703.62
8	725	703.968	9.168	21038556	4395297	610	1335	750	585	5344	1040	7740373	1015	2.20	0.37	703.25
10	725	703.76	8.96	20853195	4356742	605	1330	750	580	5163	1006	7490191	981	2.15	0.36	702.88
12	725	703.552	8.752	20667834	4318187	600	1325	750	575	4984	972	7242832	947	2.09	0.35	702.53
14	725	703.344	8.544	20482473	4279632	594	1319	750	569	4808	938	6998327	913	2.04	0.34	702.18
16	725	703.136	8.336	20297112	4241077	589	1314	750	564	4633	905	6756710	880	1.99	0.33	701.84
18	725	702.928	8.128	20111751	4202522	584	1309	750	559	4461	873	6518017	848	1.94	0.32	701.50
20	725	702.72	7.92	19926390	4163967	578	1303	750	553	4291	840	6282283	815	1.88	0.31	701.18
22	725	702.512	7.712	19741029	4125412	573	1298	750	548	4123	808	6049547	783	1.83	0.31	700.87
24	725	702.304	7.504	19555668	4086856	568	1293	750	543	3957	777	5819849	752	1.78	0.30	700.56
26	725	702.096	7.296	19370307	4048301	562	1287	750	537	3794	746	5593225	721	1.72	0.29	700.27
28	725	701.888	7.088	19184946	4009746	557	1282	750	532	3633	715	5369722	690	1.67	0.28	699.98
30	725	701.68	6.88	18999585	3971191	552	1277	750	527	3474	685	5149382	660	1.62	0.27	699.70
32	725	701.472	6.672	18814224	3932636	546	1271	750	521	3318	655	4932252	630	1.57	0.26	699.43
34	725	701.264	6.464	18628863	3894081	541	1266	750	516	3164	626	4718380	601	1.51	0.25	699.17
36	725	701.056	6.256	18443502	3855526	535	1260	750	510	3012	597	4507817	572	1.46	0.24	698.92
38	725	700.848	6.048	18258141	3816971	530	1255	750	505	2863	569	4300614	544	1.41	0.23	698.68
40	725	700.64	5.84	18072780	3778416	525	1250	750	500	2717	541	4096828	516	1.35	0.23	698.44
42	725	700.432	5.632	17887419	3739861	519	1244	750	494	2573	514	3896517	489	1.30	0.22	698.22
44	725	700.224	5.424	17702058	3701306	514	1239	750	489	2432	487	3699742	462	1.25	0.21	698.00
46	725	700.016	5.216	17516697	3662751	509	1234	750	484	2293	461	3506568	436	1.19	0.20	697.79
48	725	699.808	5.008	17331336	3624195	503	1228	750	478	2157	435	3317063	410	1.14	0.19	697.59
50	725	699.6	4.8	17145975	3585640	498	1223	750	473	2024	410	3131300	385	1.09	0.18	697.40
52	725	699.392	4.592	16960614	3547085	493	1218	750	468	1894	385	2949355	360	1.04	0.17	697.22
54	725	699.184	4.384	16775253	3508530	487	1212	750	462	1767	361	2771312	336	0.99	0.16	697.05
56	725	698.976	4.176	16589892	3469975	482	1207	750	457	1643	337	2597256	312	0.93	0.16	696.88
58	725	698.768	3.968	16404531	3431420	477	1202	750	452	1522	314	2427282	289	0.88	0.15	696.73
60	725	698.56	3.76	16219170	3392865	471	1196	750	446	1404	292	2261490	267	0.83	0.14	696.58
62	725	698.352	3.552	16033809	3354310	466	1191	750	441	1289	270	2099988	245	0.78	0.13	696.44
64	725	698.144	3.344	15848448	3315755	461	1186	750	436	1177	249	1942894	224	0.73	0.12	696.31
66	725	697.936	3.136	15663087	3277200	455	1180	750	430	1069	228	1790335	203	0.68	0.11	696.19
68	725	697.728	2.928	15477726	3238645	450	1175	750	425	964	208	1642450	183	0.63	0.11	696.08
70	725	697.52	2.72	15292365	3200089	444	1169	750	419	864	189	1498391	164	0.58	0.10	695.97
72	725	697.312	2.512	15107004	3161534	439	1164	750	414	766	171	1361327	146	0.54	0.09	695.87
74	725	697.104	2.304	14921643	3122979	434	1159	750	409	673	153	1228447	128	0.49	0.08	695.78
76	725	696.896	2.096	14736282	3084424	428	1153	750	403	584	136	1100960	111	0.45	0.07	695.70
78	725	696.688	1.888	14550921	3045869	423	1148	750	398	499	120	979105	95	0.40	0.07	695.63
80	725	696.48	1.68	14365560	3007314	418	1143	750	393	419	105	863156	80	0.36	0.06	695.56
82	725	696.272	1.472	14180199	2968759	412	1137	750	387	344	90	753430	65	0.32	0.05	695.50
84	725	696.064	1.264	13994838	2930204	407	1132	750	382	274	77	650304	52	0.28	0.05	695.45
86	725	695.856	1.056	13809477	2891649	402	1127	750	377	209	65	554229	40	0.24	0.04	695.40
88	725	695.648	0.848	13624116	2853094	396	1121	750	371	150	54	465767	29	0.20	0.03	695.36
90	725	695.44	0.64	13438755	2814539	391	1116	750	366	99	44	385641	19	0.17	0.03	695.33
92	725	695.232	0.432	13253394	2775983	386	1111	750	361	55	35	314830	10	0.14	0.02	695.30
94	725	695.024	0.224	13068033	2737428	380	1105	750	355	20	29	254773	4	0.12	0.02	695.28
96	725	694.816	0.016	12882672	2698873	375	1100	750	350	0	25	207918	0	0.10	0.02	695.26
					173036059	c.f.						172969142				

Boyce Hydro Gate Discharges 6/17/2013 All values are with pond at summer level.

SANFORD (8.5')

22 foot gates

#2 open ft.	Q, cfs	+ #3 open, ft	Q, cfs	+ #4 open, ft	Q, cfs	+ #5 open, ft	Q, cfs
1	350	1	2449	1	4548	1	6647
2	677	2	2776	2	4875	2	6974
3	981	3	3080	3	5179	3	7278
4	1260	4	3359	4	5458	4	7557
5	1514	5	3613	5	5712	5	7811
6	1739	6	3838	6	5937	6	8036
7	2099	7	4198	7	6297	7	8396

25 foot gates

+ #1 open, ft	Q, cfs	+ #6 open, ft	Q, cfs
1	8793	1	11178
2	9165	2	11550
3	9511	3	11896
4	9828	4	12213
5	10116	5	12501
6	10372	6	12757
7	10781	7	13166

EDENVILLE (8')

Tobacco

23.58' gates

#1 open ft.	Q, cfs	+ #3 open, ft	Q, cfs
1	363	1	2417
2	701	2	2755
3	1013	3	3067
4	1298	4	3352
5	1553	5	3607
6	1777	6	3831
7	2054	7	4108

20 ft gate

+#2 open, ft	Q, cfs
1	4416
2	4703
3	4968
4	5209
5	5426
6	5616
7	5851

Tittabawassee

23.58' gate

#3 open, ft	Q, cfs
1	6213
2	6552
3	6864
4	7149
5	7404
6	7628
7	7905

20 foot gates

+ #2 open, ft	Q, cfs	+ #1 open, ft	Q, cfs
1	8213	1	9955
2	8499	2	10242
3	8764	3	10506
4	9006	4	10748
5	9222	5	10965
6	9412	6	11155
7	9647	7	11389

SMALLWOOD (10')

25.35 ft gates

#1 open ft	Q, cfs	+#2 open ft	Q, cfs
1	439	1	3525
2	854	2	3941
3	1246	3	4332
4	1611	4	4697
5	1950	5	5036
6	2261	6	5347
7	3086	7	6173

SECORD (8')

20.5 ft gate

#1 open ft	Q, cfs
1	315
2	609
3	881
4	1128
5	1350
6	1545
7	1786

23.83 ft gate

+#2 open ft	Q, cfs
1	2152
2	2494
3	2810
4	3097
5	3356
6	3582
7	3862

011

9/20/13

Time to Lower Reservoir

Eden Reservoir - 2600 Ac @ 675.8 = 113,256,000 S.F.
1800 Ac @ 667.8 = 76,408,000
34,848,000 S.F.

for 4 days (96 hrs), @ 1"/hr. for 2 hrs, Area lost =
= 34,848,000 ÷ 47 = 741,447 s.f./2 hrs

Gate discharge Available = $CLH^{3/2}$ C = 3.85
L = 3@23 + 3@20 = 129'
= $3.85(129)H^{3/2}$ = $496.65H^{1.5}$

for 3 days (72 hrs) @ 1.33"/hr, for 2 hr. Area lost =
= 34,848,000 ÷ 35 = 995,657 s.f./2 hrs

Secord Reservoir - 1100 Ac. @ 750.8 = 47,916,000 s.f.
700 Ac. @ 742.8 = 30,492,000 s.f.
17,424,000 s.f.

for 4 days (96 hrs) @ 1"/hr. for 2 hrs, Area lost =
= 17,424,000 ÷ 47 = 370,723 s.f./2 hrs.

Gate discharge Available = $CLH^{3/2}$ C = 3.85
L = 44' (2 gates)
= $3.85(44)H^{3/2}$ = $169.4H^{3/2}$

Smallwood Reservoir - 500 Ac. @ 704.8 = 21,780,000 s.f.
- 300 Ac. @ 694.8 = 13,068,000
8,712,000 s.f.

for 4 days 8,712,000 ÷ 47 = 185,361 s.f./2 hrs.
L = 50' (2 gates)

2. Early Warning System for Emergency Action Plan

Our first segment of the early warning system deals with the advanced weather forecasting information we receive daily. Attached are three sheets published on September 26 showing the information available for our location and zip code. The first two pages show the September and October long range forecasting. In the case of September on this day it shows what happened on the previous days of the month. The third sheet shows the five day forecast and by highlighting the day forecast for rain we can get the amount of precipitation expected, 0.04 inches during the day and none at night. We can also access hourly updated radar maps showing storm patterns across the county and more specifically in the central states area. With this kind of information we can track forecasted storms weeks in advance.

Our Emergency Action Plan would be upgraded in the following manner to include the flood tracking and early warning system. The Section **IV. Emergency Detection, Evaluation and Classification** will be modified in as follows:

IV. Emergency Forecasting, Detection, Evaluation and Classification

This section discusses the procedures for timely and reliable forecasting, detection, evaluation and classification of a forecasted, potential or existing emergency condition.

Forecasting

By utilizing the National Weather System forecasting information available on the web, we can identify future and potentially very severe storms that may be headed our way. We will start tracking these storms as far in advance as we can (weeks if possible). If a storm has the potential of approaching a PMF event, we will notify the Emergency Management Centers of both Gladwin and Midland Counties when we feel the possibility is present and let them know we are considering a reservoir draw down procedure. We will contact both offices on a daily basis, or when a significant change has been noted, to keep abreast of the conditions and what our future actions may be. When a decision has been made to initiate the draw down process we will notify all agencies on our Notification Flow Chart, Condition B, with a notice that we are beginning a reservoir draw down in anticipation of a PMF level flood. Again it is noted that the decision to call the agencies and to begin the draw down process must be made by the General Manager (Dam Safety Engineer), or next in line on the responsibility list.

The reservoir draw down will be accomplished over a 3 or 4 day period. Attached are spread sheets showing the means by which the reservoirs may be lowered under different inflow conditions and over 3 or 4 days. We should begin lowering all reservoirs at the same time. The gates must be opened more in the beginning to get a head start on the lowering process to accomplish the full draw down. The last four columns on the sheets show the gate discharge and the rate that needs to be implemented to reach draw down. With our gate discharge table and the two hour target elevations shown on the spread sheets we can regulate the process to achieve the full lowering.

Detection..... (continue)


ther Forecast for MI 48620 - Mozilla Firefox
/october-weather/2113?_pjax=on&yr=10/1/2013
Sep 29
30
Oct 1
2
3
4
5
Rain possible; not as warm
70° Lo 51°
Hist. Avg. 66° Lo 46°
6
Bright sunshine
68° Lo 48°
Hist. Avg. 66° Lo 45°
7
Mostly sunny
69° Lo 51°
Hist. Avg. 66° Lo 45°
8
Bright sunshine
73° Lo 54°
Hist. Avg. 65° Lo 44°
9
Plenty of sun
65° Lo 53°
Hist. Avg. 65° Lo 44°
10
Mostly cloudy with a t-storm
71° Lo 51°
Hist. Avg. 64° Lo 44°
11
Cloudy with a little rain
68° Lo 46°
Hist. Avg. 64° Lo 43°
12
Abundant sunshine
68° Lo 47°
Hist. Avg. 63° Lo 43°
13
A few showers in the morning
70° Lo 47°
Hist. Avg. 63° Lo 43°
14
Sunny
71° Lo 48°
Hist. Avg. 63° Lo 42°
15
Cloudy
69° Lo 47°
Hist. Avg. 62° Lo 42°
16
Sunny
68° Lo 49°
Hist. Avg. 62° Lo 42°
17
Sun and clouds
67° Lo 48°
Hist. Avg. 61° Lo 41°
18
Clouds and sun
66° Lo 48°
Hist. Avg. 61° Lo 41°
19
Mostly cloudy
66° Lo 47°
Hist. Avg. 60° Lo 41°
20
Partial sunshine
65° Lo 45°
Hist. Avg. 60° Lo 40°
21
Sunshine
65° Lo 47°
Hist. Avg. 60° Lo 40°
22
Considerable cloudiness
65° Lo 46°
Hist. Avg. 59° Lo 40°
23
Sunshine and some clouds
63° Lo 45°
Hist. Avg. 59° Lo 40°
24
Rain
62° Lo 40°
Hist. Avg. 58° Lo 39°
25
Colder; a few morning showers
52° Lo 39°
Hist. Avg. 58° Lo 39°
26
Partly sunny
59° Lo 40°
Hist. Avg. 58° Lo 37°
27
Partly sunny
56° Lo 45°
Hist. Avg. 57° Lo 39°
28
Rain
57° Lo 44°
Hist. Avg. 57° Lo 38°
29
Overcast with a little rain
51° Lo 42°
Hist. Avg. 56° Lo 38°
30
Cloudy with a little rain
50° Lo 36°
Hist. Avg. 56° Lo 38°
31
Windy with low clouds
48° Lo 39°
Hist. Avg. 56° Lo 38°
Nov 1
Clouds, a shower
49° Lo 40°
Hist. Avg. 55° Lo 37°
2

Edenville September Weather 2013 - AccuWeather Forecast for MI 48620 - Mozilla Firefox

www.accuweather.com/en/us/edenville-mi/48620/september-weather/21143_pc

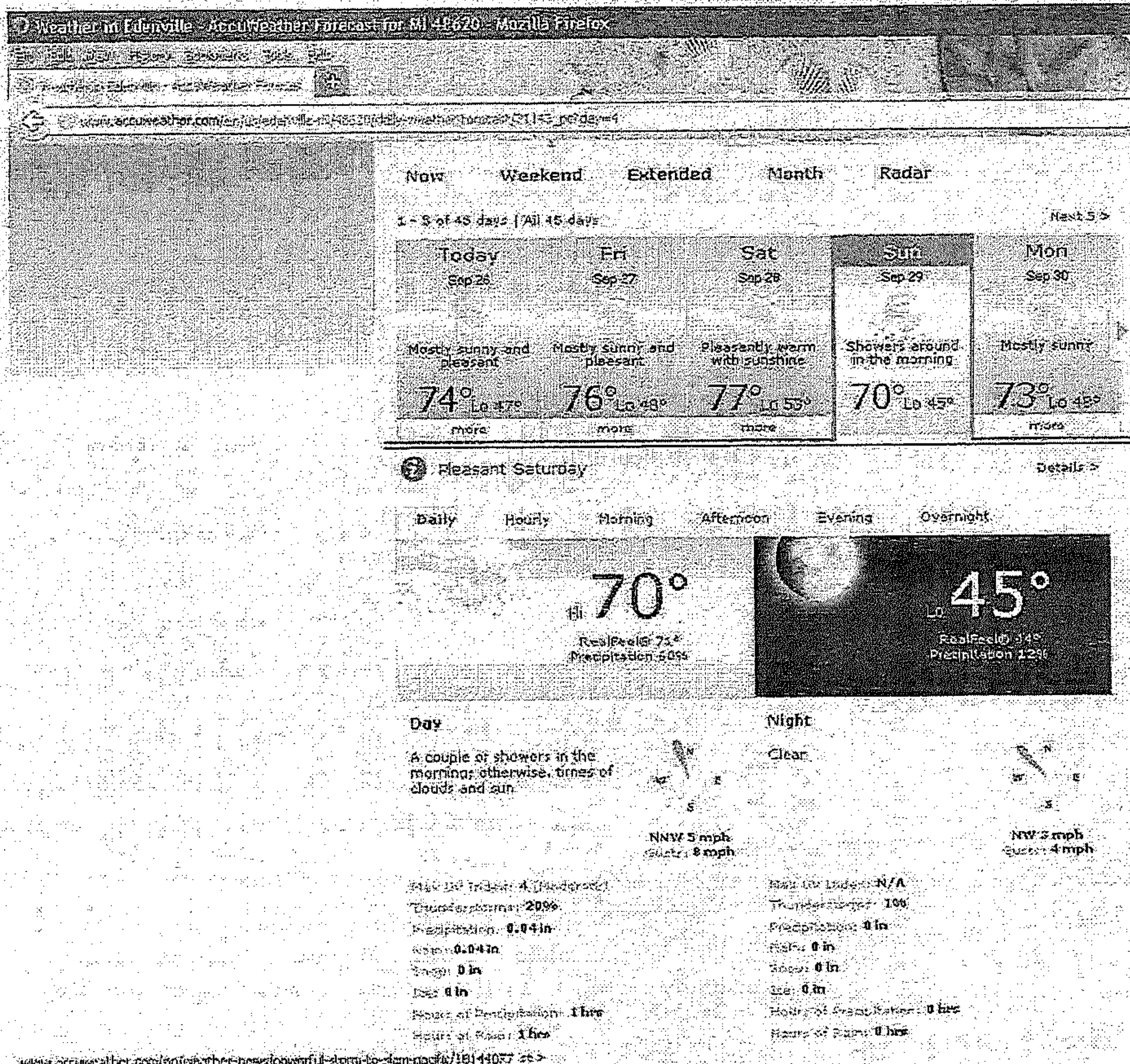
AccuWeather.com for Edenville, MI

United States WEATHER | Edenville, MI LOCAL WEATHER | ALLERGIES

Now Weekend Extended Month Radar

< August 2013 View: September 2013 October 2013 >

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Sep 1	2	3	4	5	6	7
Actual Temp 76° Lo 59° Hist. Avg. 77° Lo 56°	Actual Temp 71° Lo 58° Hist. Avg. 77° Lo 55°	Actual Temp 76° Lo 54° Hist. Avg. 77° Lo 55°	Actual Temp 82° Lo 55° Hist. Avg. 76° Lo 55°	Actual Temp 69° Lo 47° Hist. Avg. 76° Lo 54°	Actual Temp 76° Lo 48° Hist. Avg. 76° Lo 54°	Actual Temp 76° Lo 63° Hist. Avg. 75° Lo 54°
8	9	10	11	12	13	14
Actual Temp 71° Lo 54° Hist. Avg. 75° Lo 53°	Actual Temp 78° Lo 52° Hist. Avg. 75° Lo 53°	Actual Temp 95° Lo 73° Hist. Avg. 74° Lo 53°	Actual Temp 87° Lo 65° Hist. Avg. 74° Lo 52°	Actual Temp 77° Lo 54° Hist. Avg. 74° Lo 52°	Actual Temp 62° Lo 43° Hist. Avg. 73° Lo 52°	Actual Temp 70° Lo 38° Hist. Avg. 75° Lo 51°
15	16	17	18	19	20	21
Actual Temp 61° Lo 52° Hist. Avg. 73° Lo 51°	Actual Temp 59° Lo 43° Hist. Avg. 72° Lo 50°	Actual Temp 69° Lo 37° Hist. Avg. 72° Lo 50°	Actual Temp 79° Lo 42° Hist. Avg. 71° Lo 50°	Actual Temp 80° Lo 52° Hist. Avg. 71° Lo 49°	Actual Temp 78° Lo 65° Hist. Avg. 70° Lo 49°	Actual Temp 68° Lo 52° Hist. Avg. 70° Lo 48°
22	23	24		Today	27	28
				Mostly sunny and	Mostly sunny and	Pleasantly warm


Weather in Edenville - AccuWeather Forecast for MI 48620 - Mozilla Firefox
Now
Weekend
Extended
Month
Radar
1 - 5 of 45 days | All 45 days
Next 5 >
Today
Sep 26
Mostly sunny and pleasant
74° Lo 47°
more
Fri
Sep 27
Mostly sunny and pleasant
76° Lo 48°
more
Sat
Sep 28
Pleasantly warm with sunshine
77° Lo 55°
more
Sun
Sep 29
Showers around in the morning
70° Lo 45°
Mon
Sep 30
Mostly sunny
73° Lo 45°
more
Pleasant Saturday
Details >
Daily
Hourly
Morning
Afternoon
Evening
Overnight
Hi 70°
Lo 45°
Day
A couple of showers in the morning; otherwise, times of clouds and sun
NNW 5 mph
Gusts: 8 mph
Night
Clear
NW 3 mph
Gusts: 4 mph
Thunderstorms: 20%
Precipitation: 0.04 in
Rain: 0.04 in
Snow: 0 in
Ice: 0 in
Hours of Precipitation: 1 hrs
Hours of Rain: 1 hrs
Max UV Index: N/A
Precipitation: 0 in
Rain: 0 in
Snow: 0 in
Ice: 0 in
Hours of Precipitation: 0 hrs
Hours of Rain: 0 hrs

3. PMF HEC-RAS Analysis of the Pre-lowered the Reservoirs

Attached is a copy of the Edenville Dam Pre-draw Analysis, dated September 29, 2013, by Mill Road Engineering. In the Report a current condition is compared to the pre-draw situation, both as the spillways exists today. In the tables it documents that a peak condition on the Tittabawassee side occurs eight hours before the peak on the Tobacco side. A reduction occurs in the total peak of the PMF for the pre-draw condition of approximately 1,900 cfs at hour 62. The peak water surface elevation is lowered by about 0.1 foot under the pre-draw condition.

Edenville Dam Pre-draw Analysis

LP-10808

FOR

BOYCE HYDRO POWER, LLC

September 20, 2013

Revision 2 September 30, 2013

PREPARED BY

Stephen C. Doret, P.E

Mill Road Engineering
23 Mill Road
Westborough, MA 01581

TABLE OF CONTENTS

1.0 Introduction

1.1 Purpose

The purpose of this study is to determine the impact on the PMF analysis of pre-drawing the reservoirs in the Tittabawassee River System from normal reservoir level to the spillway crest. The normal circumstance in a PMF analysis is to start a PMF analysis at normal reservoir with no units running and then route the PMF storm through the system. In this study the reservoirs at Secord, Smallwood and Edenville/Tobacco were drawn to the Tainter gate spillway crest. The units at Edenville were anticipated to be running. This assumption provides an additional discharge flow which varies but is about 2000 cfs depending on the actual head on the system. A pre-drawn condition is essentially a 10 foot draw down as the precursor to a PMF analysis.

1.2 Description of Study

The study uses the PMF HEC RAS model developed to determine the spillway modifications previously approved which resulted in the revised spillway design where the spillway crests at Edenville and Tobacco were modified. Currently the spillway crest in each location is at elevation 667.8 feet. The redesigned spillways would have a crest at elevation 654.8 feet. The PMF study when the spillways were modified to that elevation produced a PMF from the project at 61790 CFS.

This study uses the previous model for runoff and set the starting reservoir elevation to the spillway crest at each reservoir (Edenville, Smallwood and Secord). As a comparison the existing reservoir system was also be modeled with the PMF storm hydrographs using the existing spillways and normal reservoir elevation. The results of the pre-draw condition are compared to the existing system with the PMF storm rainfall and run off occurring with the reservoirs at their normal elevations.

The model results are created in tabular and graphic form. Our goal is to determine the effectiveness of the pre-draw on the PMF peak timing and the discharge peak flow from the reservoir operated at the normal elevation as the starting elevation of the PMF event.

2.0 Project Description at the Edenville Dam

2.1 General

The Tittabawassee Dams were constructed during the period from 1923 to 1925. First generation occurred in 1925.

The reservoir system includes Secord, Smallwood, Edenville and Sanford dams and their powerhouses. The projects were not originally licensed by FERC. The first FERC license was issued for Sanford project in 1987. All projects were issued a FERC license in 1998. At that time all projects were required to meet FERC regulations and each of the projects were improved over the period of time which has elapsed since the 1998 licenses were issued. Smallwood and Sanford were improved to pass the Inflow Design Flood (IDF) and Secord is believed to be adequate to pass the PMF since the reservoir will not be overtopped at the dam during the PMF. Edenville is the focus of the PMF effort at this time.

The Edenville project has two spillways, one on the Tobacco River and one on the Tittabawassee River normally called the Edenville Spillway. Each of the two spillways has three gates, two on the Edenville side at 20 feet and the other at 23'-7". The Tobacco Spillway has two gates at 23'-7" and one at 20'. All spillway crests have a sill elevation at 667.8 feet.

2.2 Edenville Dam Project PMF Studies

The Edenville Dam project PMF studies have been ongoing for a number of years. The original owners of the project, Wolverine Power Company began PMF studies in 1994. During that period rainfall and run off to the reservoir was determined by Mead and Hunt. That data including the storm hydrographs at a number of locations in the Tobacco and Tittabawassee Rivers were created. Those storm hydrographs have been used in the current HEC RAS model for this study.

During the years of the ongoing PMF study, Boyce Hydro Power, LLC has chosen to rehabilitate the existing spillways and at the same time to lower the spillway crest from the current elevation of 667.8 to 654.8 feet MSL. A design to accomplish that goal was completed and submitted to FERC. As a result of a number of joint FERC-BOC meetings the design was vetted and was accepted as the method of satisfying the PMF criteria for the Edenville Project, P-10808 in November 2012. Once the design was approved, FERC requested a schedule for execution. Construction start was scheduled for June of 2013. However, prior to the time scheduled for construction start, Boyce Hydro Power, LLC notified FERC that it did not have the finances to begin construction as previously anticipated. FERC scheduled a meeting in Washington on August 9, 2013 to deal with this event and requested that Boyce Hydro, LLC. meet with the BOC, FERC and its staff to discuss alternatives to resolve the PFM concern at the Project.

This study is the first effort to develop a response to one of questions created during the meeting of August 9, 2013. That question being the effect of reservoir pre-draw on the PMF.

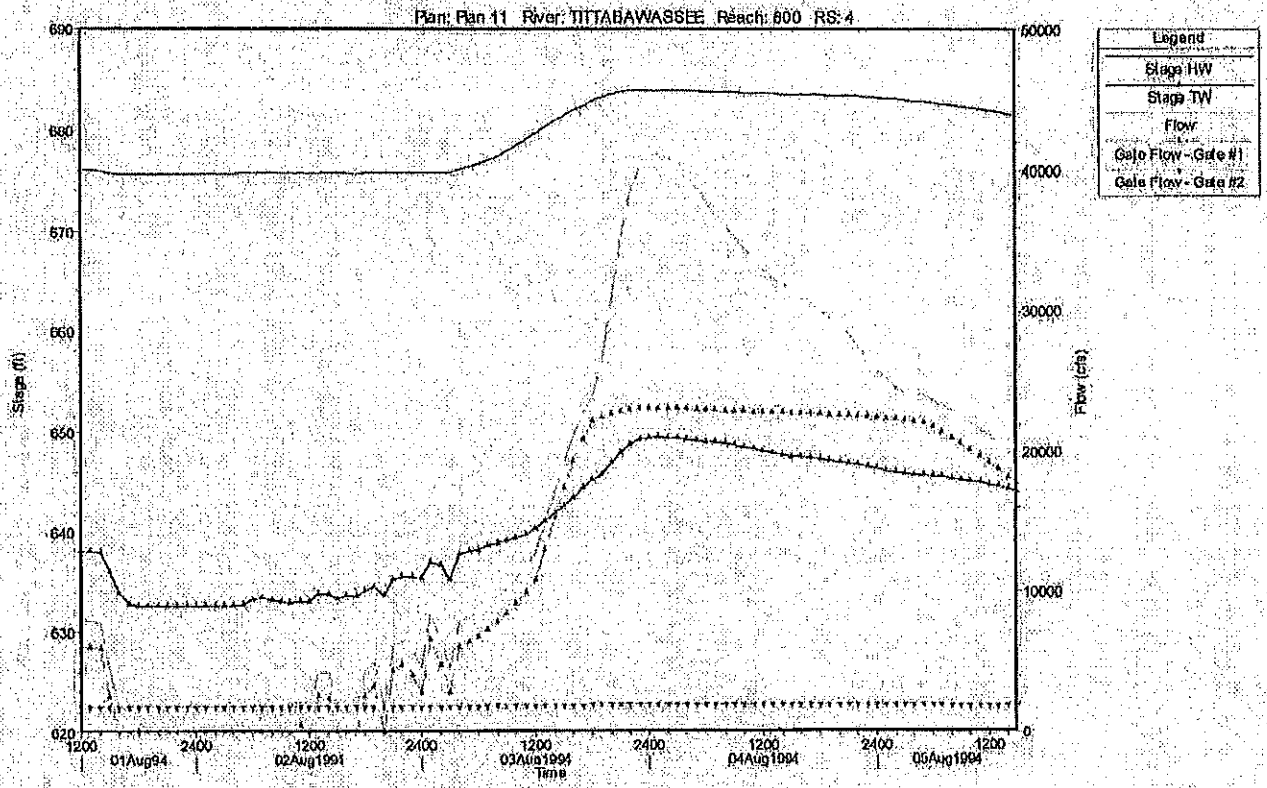
3.0 Results

The PMF HEC RAS model was modified to return the spillway crests to their original opening width and crest elevation. The model was then run using the normal starting elevation of the reservoirs. The Edenville units were modeled in the system by adding a discharge gate of proper size and at the centerline of the existing units to mimic the unit performance. A discharge value was chosen at the anticipated head and a gate of the proper size was created to discharge the equivalent amount of water. A gate was a good choice because the flow rate will vary as function of the operating head on the gate which is a result of the tail and head water elevation which the model will create on time step basis.

The critical result of the model run was to determine the hour by hour reservoir elevation and the spillway discharge at each spillway. This information was used as the base for comparison to determine the efficacy of reservoir pre-draw model run which is the goal of this study.

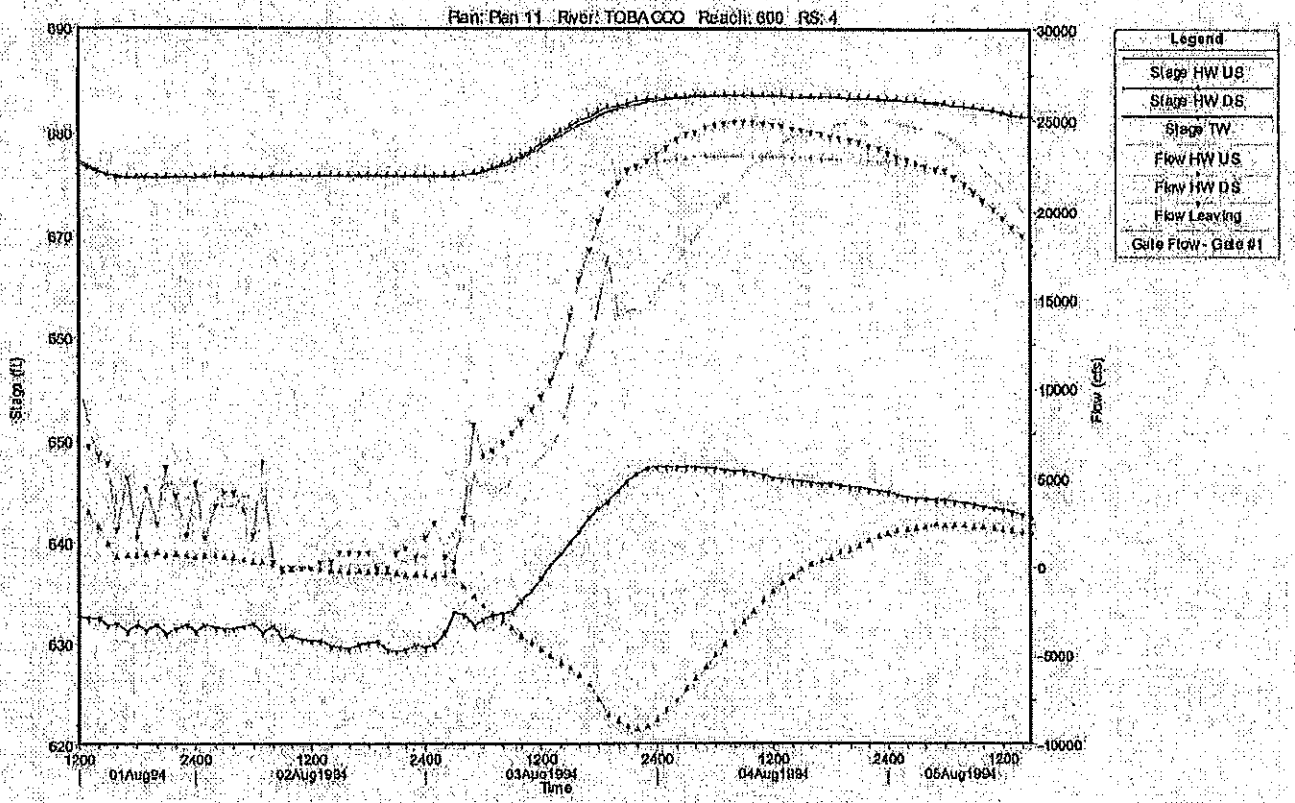
When this run was successful, the model was again modified to set the starting reservoir elevation to the spillway crest elevation for each reservoir, Secord, Smallwood and Edenville. The hour by hour values of total discharge and reservoir elevation at the Edenville and Tobacco Spillway was recorded. The difference in value for each of these parameters hour by hour was compared to the same results as determined for the model run where the PMF inflows were modeled with the reservoir at normal elevation.

Graphs of the Tobacco and Edenville Spillway results are provided below for both the normal reservoir PMF result as well as the pre-drawn reservoir PMF result.



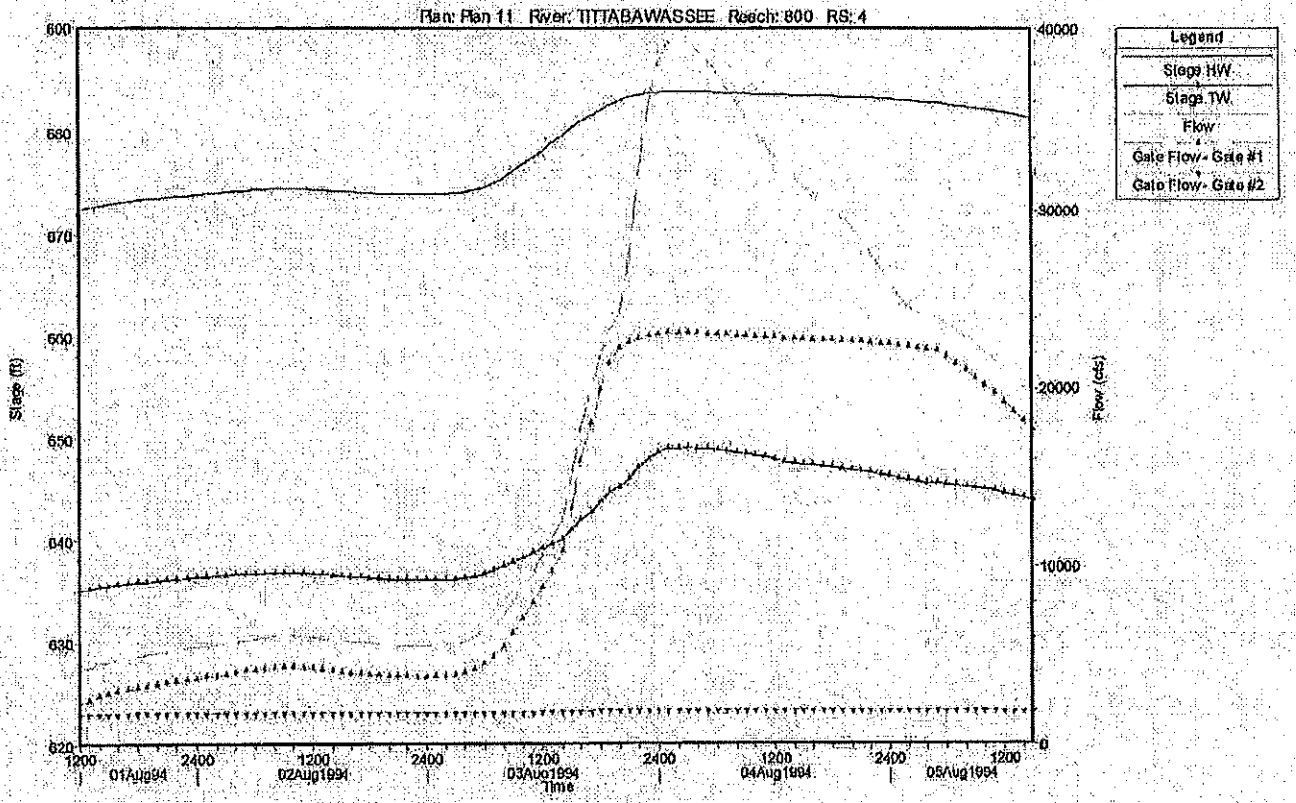
EDENVILLE PMF NORMAL RESERVOIR STARTING ELEVATION*

Gate 1 in this graph has the meaning of gate group 1, gate group 1 is the spillway group of three gates assumed to operate uniformly under an automatic control by matching the set reservoir level to open and close. Gate #2 is used to mimic the station units and as can be seen in this figure vary slightly as the head on the gate changes. The gate was sized such that the normal condition it would discharge the approximate flow of the units in operation.



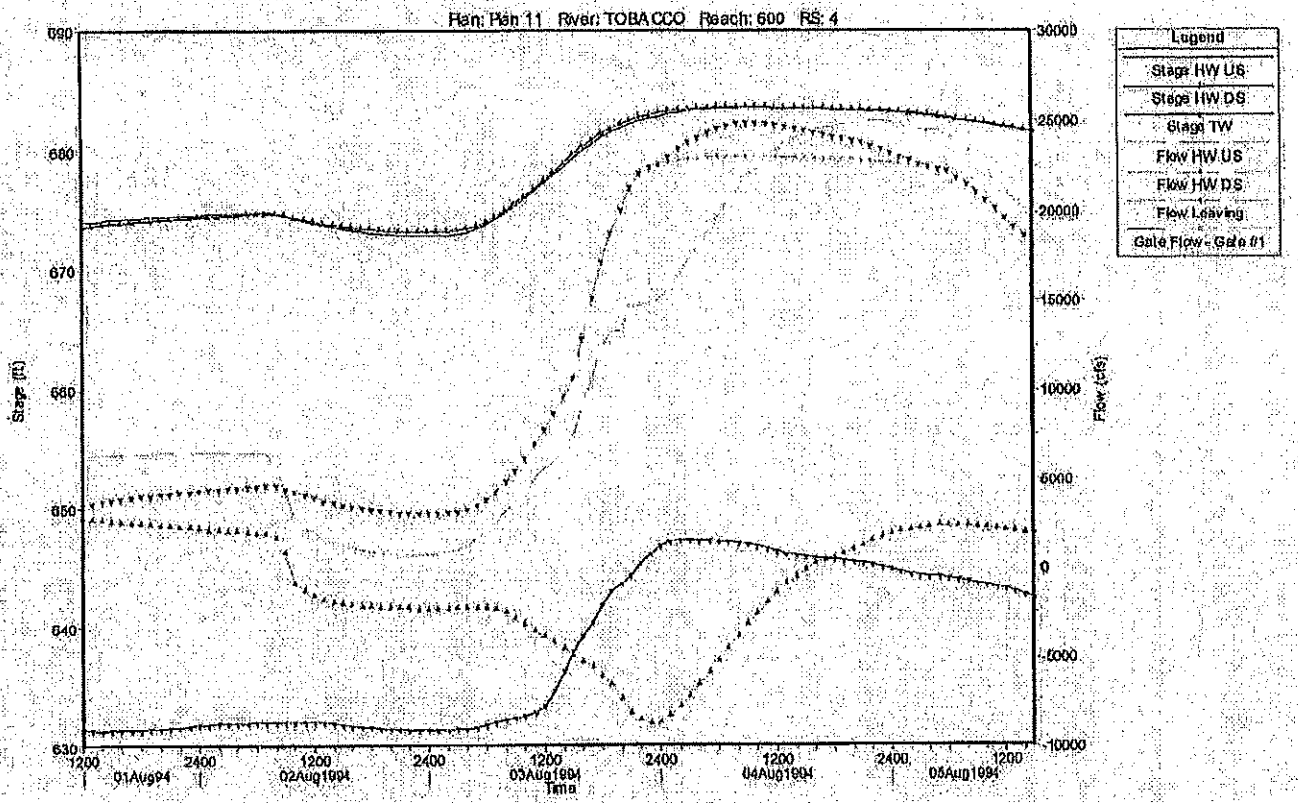
TOBACCO PMF NORMAL RESERVOIR STARTING ELEVATION

The Tobacco Gates are modeled as gates lateral to the flow direction from Tobacco upstream through the M-30 causeway and then normally discharged through the Edenville powerhouse. Upstream and downstream have meaning in that context.



EDENVILLE PMF PREDRAWN RESERVOIR STARTING ELEVATION*

Gate 1 in this graph has the meaning of gate group 1, gate group 1 is the spillway group of three gates assumed to operate uniformly under an automatic control by matching the set reservoir level to open and close. Gate #2 is used to mimic the station units and as can be seen in this figure vary slightly as the head on the gate changes. The gate was sized such that in the normal condition it would discharge the approximate flow of the units in operation.
As is seen in this result eventhough the reservoir is predrawn to the spillway crest, during the first hour the reservoir has recovered sufficient to begin discharge downstream.



TOBACCO PMF PREDRAWN RESERVOIR STARTING ELEVATION

The Tobacco Gates are modeled as gates lateral to the flow direction from Tobacco upstream through the M-30 causeway and then normally discharged through the Edenville powerhouse. Upstream and downstream have meaning in that context. Even thought the model used the initial spillway crest elevation for both the Edenville and Tobacco Reservoirs, the excess flow in the Tobacco basis must flow through the causeway to reach the discharge point under normal conditions. The spillway gates at Tobacco begin to open as soon as water is on the gates but little discharge flow occurs until sufficient head on the crest results in a significant discharge.

	Edenville Normal		Edenville Pre-draw		El Differ Normal-Pre-draw	Q Diff
hrs	Res Elevation	Res Flow	Res Elevation	Res Flow	Feet	Q-CFS
1	676	7867	673	4278	3	3590
2	676	7860	673	4497	3	3364
3	676	7706	673	4618	3	3088
4	676	3656	673	4758	3	-1102
5	676	1787	673	4842	3	-3055
6	676	1787	673	4965	2	-3178
7	676	1787	673	5038	2	-3252
8	676	1786	674	5153	2	-3367
9	676	1786	674	5224	2	-3437
10	676	1787	674	5328	2	-3541
11	676	1787	674	5405	2	-3619
12	676	1787	674	5490	2	-3703
13	676	1786	674	5584	2	-3797
14	676	1787	674	5647	2	-3860
15	676	1787	674	5726	2	-3939
16	676	1787	674	5807	2	-4020
17	676	3483	674	5883	1	-2400
18	676	2476	674	5954	1	-3478
19	676	2710	674	6023	1	-3313
20	676	3656	675	6087	1	-2432
21	676	1787	675	6133	1	-4346
22	676	1787	675	6126	1	-4339
23	676	3981	675	6084	1	-2103
24	676	3657	674	6031	1	-2373
25	676	1787	674	5972	1	-4185
26	676	1787	674	5913	1	-4125
27	676	3488	674	5855	2	-2366
28	676	2923	674	5801	2	-2878
29	676	2205	674	5752	2	-3548
30	676	1787	674	5707	2	-3920
31	676	1787	674	5663	2	-3876
32	676	3122	674	5627	2	-2505
33	676	1787	674	5601	2	-3814
34	676	1787	674	5579	2	-3792
35	676	6172	674	5570	2	602
36	676	5546	674	5570	2	-24
37	675	8572	674	5586	1	2985
38	676	7668	674	5620	2	2048

39	676	10119	674	5674	2	4444
40	676	7898	674	5784	2	2114
41	676	8184	674	5975	2	2209
42	677	8588	675	6280	2	2308
43	677	9073	675	6697	2	2377
44	677	9606	676	7296	2	2310
45	678	10273	676	8015	2	2257
46	678	11003	677	8844	2	2160
47	679	11809	678	9734	2	2076
48	680	12681	678	10654	1	2027
49	680	14859	679	11592	1	3266
50	681	17248	680	12673	1	4575
51	681	19324	680	15171	1	4153
52	682	21193	681	17780	1	3413
53	682	22772	682	19924	1	2848
54	683	24036	682	21791	1	2245
55	683	26238	683	23292	1	2945
56	684	30932	683	24163	1	6769
57	684	35238	683	27543	0	7696
58	684	38374	684	32108	0	6266
59	684	40230	684	35763	0	4467
60	684	41083	684	38060	0	3023
61	684	41233	684	39196	0	2038
62	684	40887	684	39502	0	1384
63	684	40344	684	39371	0	973
64	684	39657	684	38837	0	820
65	684	38829	684	38297	0	532
66	684	37950	684	37542	0	408
67	684	37075	684	36758	0	318
68	684	36159	684	35962	0	197
69	684	35302	684	35173	0	129
70	684	34506	684	34405	0	100
71	684	33749	684	33669	0	80
72	684	33025	684	32968	0	57
73	684	32382	684	32352	0	30
74	684	31877	684	31872	0	5
75	684	31405	684	31396	0	9
76	684	30958	684	30955	0	3
77	683	30490	683	30509	0	-19
78	683	30072	683	30083	0	-10
79	683	29568	683	29562	0	6
80	683	29004	683	29002	0	2
81	683	28396	683	28396	0	0
82	683	27544	683	27553	0	-9

83	683	26712	683	26710	0	2
84	683	25874	683	25881	0	-6
85	683	25139	683	25146	0	-7
86	683	24545	683	24549	0	-5
87	683	24178	683	24178	0	0
88	683	24096	683	24097	0	0
89	683	23999	683	23999	0	0
90	683	23684	683	23683	0	1
91	683	23306	683	23308	0	-1
92	682	22892	682	22893	0	-1
93	682	22472	682	22473	0	-1
94	682	22038	682	22039	0	-1
95	682	21600	682	21598	0	2
96	682	21123	682	21127	0	-4
97	682	20617	682	20618	0	-1
98	682	20102	682	20098	0	4
99	681	19567	681	19569	0	-2

	Tobacco	Normal	Tobacco	Pre-draw	El Differ	Q Diff
	Res	Res	Res	Res	Normal-Pre-draw	
hrs	Elevation	Flow	Elevation	Flow	Feet	Q-CFS
1	677.32	7242.94	674.12	3607.63	3	3635
2	676.89	6803.34	674.21	3725.93	3	3077
3	676.41	6310.68	674.27	3797.16	2	2514
4	676.03	5916.29	674.34	3877.92	2	2038
5	675.87	5762.46	674.38	3930.34	1	1832
6	675.83	5721.33	674.44	4005.65	1	1716
7	675.81	5704.72	674.48	4049.58	1	1655
8	675.8	5700.31	674.53	4117.63	1	1583
9	675.81	5704.65	674.56	4159.41	1	1545
10	675.81	5704.88	674.61	4222.14	1	1483
11	675.81	5711.71	674.65	4265.87	1	1446
12	675.82	5723.14	674.69	4318.62	1	1405
13	675.81	5708.61	674.73	4369.49	1	1339
14	675.82	5725.09	674.75	4404.34	1	1321
15	675.83	5731.24	674.79	4450.59	1	1281
16	675.83	5733.57	674.82	4496.55	1	1237
17	675.83	5742.41	674.86	4539.63	1	1203
18	675.83	5739.66	674.89	4579.97	1	1160
19	675.83	5741.56	674.92	4619.64	1	1122
20	675.87	424.15	674.87	4593.25	1	-4169
21	675.78	0	674.62	4398.36	1	-4398
22	675.8	0	674.42	4235.54	1	-4236
23	675.79	0	674.24	4091.61	2	-4092
24	675.8	0	674.02	3915.11	2	-3915
25	675.79	928.5	673.83	3758.47	2	-2830
26	675.8	693.92	673.67	3625.52	2	-2932
27	675.8	421.31	673.53	3509.64	2	-3088
28	675.81	421.41	673.4	3409.15	2	-2988
29	675.81	0	673.3	3325.39	3	-3325
30	675.81	929.68	673.21	3250.7	3	-2321
31	675.8	929.48	673.13	3187.73	3	-2258
32	675.81	929.69	673.07	3134.16	3	-2204
33	675.81	929.98	673.02	3095.61	3	-2166
34	675.8	1143.39	672.98	3065.83	3	-1922
35	675.82	1344.88	672.96	3050.24	3	-1705
36	675.84	422.76	672.96	3047.84	3	-2625
37	675.84	932.88	672.98	3064.41	3	-2132
38	675.83	1345.59	673.02	3102.43	3	-1757
39	675.87	1150.82	673.1	3168.4	3	-2018

40	675.91	4929.09	673.25	3295.4	3	1634
41	676.09	5595.69	673.48	3503.48	3	2092
42	676.24	8468.18	673.82	3822.37	2	4646
43	676.44	6640.75	674.27	4252.86	2	2388
44	676.75	7053.37	674.82	4824.27	2	2229
45	677.14	7575.79	675.37	5440.66	2	2135
46	677.59	8187.96	675.98	6167.73	2	2020
47	678.08	8867.32	676.65	6989.44	1	1878
48	678.61	9621.75	677.32	7843.37	1	1778
49	679.19	10469.61	677.98	8715.12	1	1754
50	679.77	11951.02	678.67	9687.48	1	2264
51	680.29	14144.16	679.37	10691.26	1	3453
52	680.78	16132.11	680.02	12880.74	1	3251
53	681.21	17828.96	680.57	15156.26	1	2673
54	681.67	19582.68	681.08	17174.71	1	2408
55	682.05	20933.37	681.5	18761.71	1	2172
56	682.3	21629.73	681.87	20109.02	0	1521
57	682.56	22315.03	682.23	21318.41	0	997
58	682.78	22506.83	682.5	22151.32	0	356
59	682.96	22787.86	682.73	22436.66	0	351
60	683.11	23175.63	682.92	22674.52	0	501
61	683.24	23579.78	683.08	23042.21	0	538
62	683.34	23958.47	683.21	23454.75	0	504
63	683.42	24284.01	683.32	23859.39	0	425
64	683.49	24392.93	683.41	24029.83	0	363
65	683.54	24621.82	683.48	24349.24	0	273
66	683.58	24789.27	683.54	24585.4	0	204
67	683.6	24898.85	683.57	24757.05	0	142
68	683.61	24955.06	683.6	24863.02	0	92
69	683.62	24972.58	683.61	24910.74	0	62
70	683.62	24950.22	683.61	24911.82	0	38
71	683.61	24897.83	683.6	24875.92	0	22
72	683.59	24813.27	683.59	24796.36	0	17
73	683.58	24714.05	683.57	24703.52	0	11
74	683.56	24603.72	683.56	24602.65	0	1
75	683.54	24494.17	683.54	24494.17	0	0
76	683.51	24378.82	683.51	24377.52	0	1
77	683.49	24261.87	683.49	24265	0	-3
78	683.47	24167.74	683.47	24169.86	0	-2
79	683.45	24059.79	683.45	24060.62	0	-1
80	683.43	23940.42	683.43	23940.42	0	0
81	683.4	23813.08	683.4	23813.08	0	0
82	683.36	23649.67	683.36	23650.1	0	0
83	683.32	23458.28	683.32	23457.85	0	0

84	683.27	23247.63	683.27	23250.96	0	-3
85	683.22	23046.66	683.22	23049.58	0	-3
86	683.16	22857.92	683.17	22859	0	-1
87	683.1	22671.32	683.1	22670.95	0	0
88	683.03	22487.04	683.03	22487.33	0	0
89	682.94	22384.03	682.94	22383.8	0	0
90	682.83	22283.11	682.83	22282.92	0	0
91	682.71	21924.47	682.71	21925.3	0	-1
92	682.58	21510.65	682.58	21510.13	0	1
93	682.44	21076.78	682.44	21076.71	0	0
94	682.31	20629.56	682.31	20630.38	0	-1
95	682.17	20171.17	682.17	20169.5	0	2
96	682.03	19667.34	682.03	19669.18	0	-2
97	681.88	19147.57	681.88	19147.64	0	0
98	681.73	18613.43	681.73	18611.22	0	2
99	681.58	18068.88	681.58	18070.08	0	-1